



South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

February 18, 2016
NOC-AE-16003324
10 CFR 50.73

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

South Texas Project
Unit 1
Docket No. STN 50-498
Licensee Event Report 2015-001-00
Manual Reactor Trip due to Lowering Steam Generator Levels and
Valid Auxiliary Feedwater System Actuation Following a Manual Main Turbine Trip

Pursuant to 10 CFR 50.73(a)(2)(iv)(A), STP Nuclear Operating Company (STPNOC) hereby submits the attached South Texas Project (STP) Unit 1 Licensee Event Report (LER) 2015-001-00 for a valid manual actuation of the Reactor Protection System and for a valid automatic actuation of the Auxiliary Feedwater System.

The event did not have an adverse effect on the health and safety of the public.

There are no commitments in this letter.

If there are any questions, please contact Wendy Brost at (361) 972-8516 or me at (361) 972-7566.

A handwritten signature in black ink, appearing to read "G. T. Powell".

G. T. Powell
Site Vice President

web

Attachment: Unit 1 LER 2015-001-00

IE22
NR

STI: 34259540

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LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid DMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME

South Texas Unit 1

2. DOCKET NUMBER

05000 498

3. PAGE

1 OF 6

4. TITLE

Manual Reactor Trip due to Lowering Steam Generator Levels and Valid Auxiliary Feedwater System Actuation Following a Manual Main Turbine Trip

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
12	21	2015	2015	001	00	02	18	2016	N/A	05000
9. OPERATING MODE			11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)							
1			<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)		<input type="checkbox"/> 50.73(a)(2)(ii)(A)		<input type="checkbox"/> 50.73(a)(2)(viii)(A)		
			<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)		<input type="checkbox"/> 50.73(a)(2)(ii)(B)		<input type="checkbox"/> 50.73(a)(2)(viii)(B)		
			<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)		<input type="checkbox"/> 50.73(a)(2)(iii)		<input type="checkbox"/> 50.73(a)(2)(ix)(A)		
			<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)		<input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)		<input type="checkbox"/> 50.73(a)(2)(x)		
10. POWER LEVEL 48%			<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)		<input type="checkbox"/> 50.73(a)(2)(v)(A)		<input type="checkbox"/> 73.71(a)(4)		
			<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)		<input type="checkbox"/> 50.73(a)(2)(v)(B)		<input type="checkbox"/> 73.71(a)(5)		
			<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)		<input type="checkbox"/> 50.73(a)(2)(v)(C)		<input type="checkbox"/> 73.77(a)(1)		
			<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)		<input type="checkbox"/> 50.73(a)(2)(v)(D)		<input type="checkbox"/> 73.77(a)(2)(i)		
			<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)		<input type="checkbox"/> 50.73(a)(2)(vii)		<input type="checkbox"/> 73.77(a)(2)(ii)		
			<input type="checkbox"/> 50.73(a)(2)(i)(C)		<input type="checkbox"/> OTHER Specify in Abstract below or in NRC Form 366A					

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT

Wendy Brost, Licensing Engineer

TELEPHONE NUMBER (Include Area Code)

3619728516

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	TA	ZT	W120	Y	B	SB	V	B040	Y

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE) ☒ NO15. EXPECTED
SUBMISSION
DATE

MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On December 21, 2015, at 1519 hours, Operators manually tripped the Unit 1 Main Turbine due to excessive load swings caused by Main Turbine Governor Valve 2 (GV2) oscillations. Prior to and following the trip of the Main Turbine, the Steam Dumps did not respond as expected, resulting in a Main Feedwater Isolation at 1524 hours due to rising Steam Generator (SG) level. Operators initiated a manual reactor trip at 1533 hours due to lowering SG levels. Approximately six seconds after the reactor trip, the Auxiliary Feedwater (AFW) system automatically actuated on a SG low level signal.

The cause of the GV2 oscillations was an intermittent ground on the signal wire to the Linear Variable Differential Transmitter (LVDT) for GV2. The fluctuations in steam flow due to the GV2 oscillations caused the spring clips in the valve positioners that modulate the Group 1 Steam Dumps to become dislodged, causing the Group 1 Steam Dumps to be unresponsive. As corrective actions, the LVDT and associated cabling for GV2 was replaced and the Group 1 Steam Dump valve positioners were repaired. The manual actuation of the Reactor Protection System and subsequent automatic AFW actuation are both reportable under 10 CFR 50.73(a)(2)(iv)(A). The event was of very low risk significance and no radioactive release occurred; therefore, there was no adverse effect on the health and safety of the public.

**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (7-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollections.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
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South Texas Unit 1	05000498	2015	- 001	- 00	2 OF 6

NARRATIVE**I. Description of reportable event****A. Reportable event classification**

This event is reportable under §50.73(a)(2)(iv)(A) as an event or condition that resulted in a manual actuation of the Reactor Protection System and also as an event or condition that resulted in an automatic actuation of the Auxiliary Feedwater (AFW) system.

B. Plant operating conditions prior to event

On December 21, 2015, Unit 1 was operating in Mode 1 at 48 percent power. Unit 1 was returning to power operation following refueling outage 1RE19.

C. Status of structures, systems, and components (SSCs) that were inoperable at the start of the event and that contributed to the event

There were no SSCs that were inoperable at the start of the event that contributed to the event.

D. Narrative summary of the event

On December 21, 2015, STP Unit 1 power ascension following a refueling outage was in progress and the reactor was at approximately 48 percent rated thermal power. At approximately 1450 hours, Operators observed Reactor Coolant System (RCS) temperature fluctuations due to turbine load swings caused by an oscillating Main Turbine Governor Valve (GV), GV2.

At 1453, Main Turbine demand rose approximately 5 percent and GV2 continued to cycle.

At 1455 hours, the Group 1 Steam Dumps opened for approximately 23 seconds. At 1456, Operators commenced load reduction on the Main Turbine to attempt to lower turbine demand. Operators observed power lowering but there was no effect on the GV2 oscillations.

At 1508 and 1510, the Group 2 Steam Dumps modulated open and closed while the Group 1 Steam Dumps remained closed due to a failure of the valve positioners.

At 1519, Operators manually tripped the Main Turbine. With reactor power less than 50 percent, as expected, the reactor did not automatically trip when the turbine tripped. When the Main Turbine Trip signal was received, the steam dump valve positioners were bypassed as designed and the Group 1, 2, and 3 Steam Dumps momentarily opened. Following the turbine trip, the steam dumps returned to a modulation mode of operation.

At 1524, a Main Feedwater Isolation occurred and the loss of feedwater resulted in lowering steam generator (SG) levels. This was due to the failure of the Group 1 Steam Dumps to modulate in response to the Main Turbine load changes, which resulted in a significant difference between steam flow and feedwater flow. Operators attempted to manually reduce feedwater flow but were not able to prevent the Main Feedwater Isolation.

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NARRATIVE

At 1529, all four SG Power Operated Relief Valves (PORVs) opened in response to the rise in steam pressure.

At 1530, Operators attempted to manually control the steam dumps but the Group 1 Steam Dumps would not modulate open.

At 1533, Operators initiated a manual reactor trip due to the lowering SG levels which is reportable under §50.73(a)(2)(iv)(A) as a valid manual actuation of the Reactor Protection System.

At 1533, approximately six seconds following the reactor trip, an AFW actuation occurred due to a SG low level signal; all four AFW pumps actuated. This event is reportable under §50.73(a)(2)(iv)(A) as a valid automatic actuation of the AFW system.

E. Method of discovery

The manual reactor trip and AFW actuation were self-revealing. Operators initiated the manual reactor trip in response to the Main Feedwater Isolation and the resulting lowering SG levels. The AFW system actuated automatically on a SG low level signal.

II. Component failures

A. Failure mode, mechanism, and effects of failed component

The component failures applicable to this Licensee Event Report (LER) are related to the LVDT wiring in GV2 and the Group 1 Steam Dumps.

The cause of the GV2 oscillations was an intermittent ground on the signal wire to the LVDT for GV2. The cause of the intermittent ground was a small score in the insulation of the LVDT signal wiring. This intermittent condition was the cause of the GV2 oscillations that resulted in Operators manually tripping the Main Turbine.

The aggressive fluctuations in steam flow due to the GV2 oscillations caused the spring clips in the Group 1 Steam Dumps to become dislodged, causing the valves to be unresponsive to modulation demands. The function of the spring clips is to provide air balance in the positioner required to modulate the valve to a controlled position. With the spring clips dislodged, the steam dumps could not modulate open; the steam dumps did maintain the ability to fully open as occurred following the turbine trip.

Total steam dump load reduction capability is 40 percent of full power. Along with 10 percent load reduction capability provided by rod control, this allows a 50 percent load reduction to occur without a reactor trip. The Group 1 Steam Dumps make up one-fourth of the steam dumps for Unit 1, so the inability of the Group 1 Steam Dumps to modulate translates to a loss of approximately ten percent load reduction capability. This condition, combined with concerns regarding SG level, resulted in Operators manually tripping the reactor.

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NARRATIVE**B. Cause of component failure**

The cause of the GV2 failure was an intermittent ground on the signal wire to the LVDT for GV2 that was the result of a small score in the insulation of the LVDT signal wiring. This wiring was vendor supplied and there is no documented history of this wiring ever being replaced or reworked. The insulation was most likely damaged during the initial installation.

The aggressive fluctuations in steam flow due to the GV2 oscillations caused the spring clips in the Group 1 Steam Dumps to become dislodged, causing the valves to be unresponsive to modulation demands. The steam dumps regularly cope with changes in steam flow during normal operation; however, the aggressive steam flow fluctuations that the Group 1 Steam Dumps experienced in this event challenged the design of the Steam Dump system, resulting in the malfunction of the spring clips on the positioners.

C. Systems or secondary functions that were affected by failure of components with multiple functions

The failed components described in the narrative, Steam Dump Group 1 and GV2, do not have multiple functions that affect other systems. The failures of these components contributed to the eventual Main Turbine trip and reactor trip.

D. Failed component information (Energy Industry Identification System (EIIS) designators provided in {brackets})

High Pressure Turbine Governor Valve Position Transmitter {ZT}
Manufacturer: Westinghouse Electric Corporation
Model: 677J444G21

Steam Dumps Valve Positioner {V}
Manufacturer: Bailey Controls
Model: AV112000

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NARRATIVE**III. Analysis of the event****A. Safety system responses that occurred**

The Reactor Protection System and AFW systems both responded to this event.

B. Duration of safety system inoperability

There were no SSCs that were inoperable at the start of the event that contributed to the event.

C. Safety consequences and implications

No Technical Specification LCOs were entered due to this event. Operators manually tripped the reactor following the Main Feedwater isolation.

For the Probabilistic Risk Assessment (PRA) analysis, the initiating event is classified as a Total Loss of Main Feedwater (TLMFW) – the isolation of main feedwater led to decreasing levels in the SG which would have inevitably resulted in an automatic reactor trip. The TLMFW event is a modeled initiating event, and no risk significant equipment was confirmed out of service.

The STP PRA was used to estimate the relevant metrics for a reactor trip, Conditional Core Damage Probability (CCDP) and Conditional Large Early Release Probability (CLERP), given that the TLMFW initiating event actually occurred. The CCDP and CLERP were determined to be 5.99E-07 and 3.36E-08, respectively, indicating very low risk significance.

The resulting risk of this event is well within the NRC acceptance criteria of less than 1E-06 events per year for the CCDP and less than 1E-07 events per year for the CLERP, as outlined in Regulatory Guide 1.174.

The event was of very low risk significance and no radioactive release occurred; therefore, there was no adverse effect on the health and safety of the public.

IV. Cause of the event

Prior to and following the manual trip of the Main Turbine, the Group 1 Steam Dumps did not respond as expected for the load shed, resulting in a Main Feedwater Isolation due to rising SG level. Operators then initiated a manual reactor trip due to lowering SG levels and the AFW system actuated automatically on a SG low level signal. There were no human performance errors that contributed to the event.

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NARRATIVE**V. Corrective actions**

As a corrective action, STP replaced the LVDT and the associated cables for GV2. Inspections were also performed on all Unit 1 governor and throttle valves following the reactor trip to ensure that the condition was limited to GV2. Inspections will be performed on the cables and wiring associated with the LVDTs and servo valves for the governor and throttle valves in Unit 2 during the next Unit 2 refueling outage.

Visual Inspections were performed on all Unit 1 Steam Dump Groups following the reactor trip. Repairs to the Group 1 Steam Dumps were completed on December 23, 2015 and the spring clips were verified to be within tolerance.

VI. Previous similar events

An Operating Experience review was conducted as part of the Cause Evaluation performed for this event.

Several failures of the High Pressure Governor valves due to loose or faulty connections, however, none of these failures resulted from insulation damage or shield grounding.

Several failures related to the steam dump valves were reviewed and none of these failures resulted from the spring clips being dislodged following a secondary transient. A similar event (Condition Report 08-4313) consisting of valve oscillations of HP Turbine GV1 led to perturbations in the secondary that cycled Electro-Hydraulic lines greater than six inches. There was no report of steam dump failures at that time.

One previous STP Unit 1 LER (2000-007-00) has been submitted related to governor valves and the steam dumps with a subsequent manual reactor trip. The cause of this event was a failed logic card and missing screw on the steam dump actuator hand wheel.